IBM

Application Program

1130 Type Composition Program

Application Description

The IBM 1130 Type Composition Program is designed to accept textual material plus format control instructions for transcription into punched paper tape output to control the operation of linecasting machines for setting type. The output tape contains the original copy in the form of properly justified lines arranged according to the specified stylistic and graphic requirements.

CONTENTS

Copies of this and other IBM publications can be obtained through IBM branch offices. Address comments concerning the contents of this publication to IBM, Technical Publications Department, 112 East Post Road, White Plains, N.Y. 10601

APPLICATION ABSTRACT

The effectiveness of any printer's composing room is measured in terms of its ability to ensure an accurate and orderly flow of copy from point of receipt to the finished product. The IBM 1130 Type Composition Program is designed to aid type compositors in one of the integral functions of type composition — the transcription of textual material into a form required by the linecasting machine for setting the type.

The requirements of speed and accuracy in a complex job make the function of tape perforation and distribution important to the success of any composing room utilizing tape-operated linecasting machines. Since this is normally the first step in a series of operations which produce the final printed text, it is an important one. This job involves not only the perforation of copy, but also strict adherence to the linecasting machine capabilities in terms of the desired printing format.

Under the direction of the 1130 Type Composition Program, the computer accepts input in the form of a six-channel paper tape containing printer-oriented format control instructions, along with the copy that is to appear in print. Input can originate from up to eight tape readers. The program interprets these format instructions, produces a tape suitable for controlling the operation of a linecasting machine, and distributes the tape to the proper output punch, which is located adjacent to the linecasting machine. Up to eight punches can be connected. The output contains the original copy in the form of properly justified lines arranged according to stylistic and graphic requirements described by the user with the format instructions.

Since the computer assumes the burden of all decisions regarding justification and hyphenation, the insertion of proper linecasting control functions, and the allocation of tape to the proper point on the composing room floor, perforator operators can concentrate on speed and accuracy of copy perforation, with resulting benefits in total type composition speed.

The function of the 1130 Type Composition Program is identical to that of the 1620 Type Composition Program, namely, to accept an input containing format instructions and the copy which is to appear in print and produce from this an output tape suitable for controlling the operation of a linecasting machine. In addition, the program logic used to implement this function is similar in both programs. The primary differences between the two programs are that the 1130 Type Composition Program provides the user with the ability to more effectively utilize the capabilities of his linecasting machine and control the format of the copy which is to appear in print.

SOURCE LANGUAGE

1130 Assembler Language

GENERAL DESCRIPTION OF THE APPLICATION

Consider the relationship among the alternate uses to which additional time could be put by one type of printing organization — a newspaper. Depending on circumstances, a gain in time could be used to (1) produce an increased number of papers with the same press capacity, (2) obtain more recent coverage of news events before going to press, (3) obtain more comprehensive coverage, (4) make deliveries earlier by going to press earlier, or (5) with delivery time unchanged, achieve greater reliability of delivery. Since any or all of these factors can affect circulation, and since circulation in turn affects revenue directly through the number of papers sold and indirectly through the volume of advertising it generates, these factors are regarded as having monetary significance.

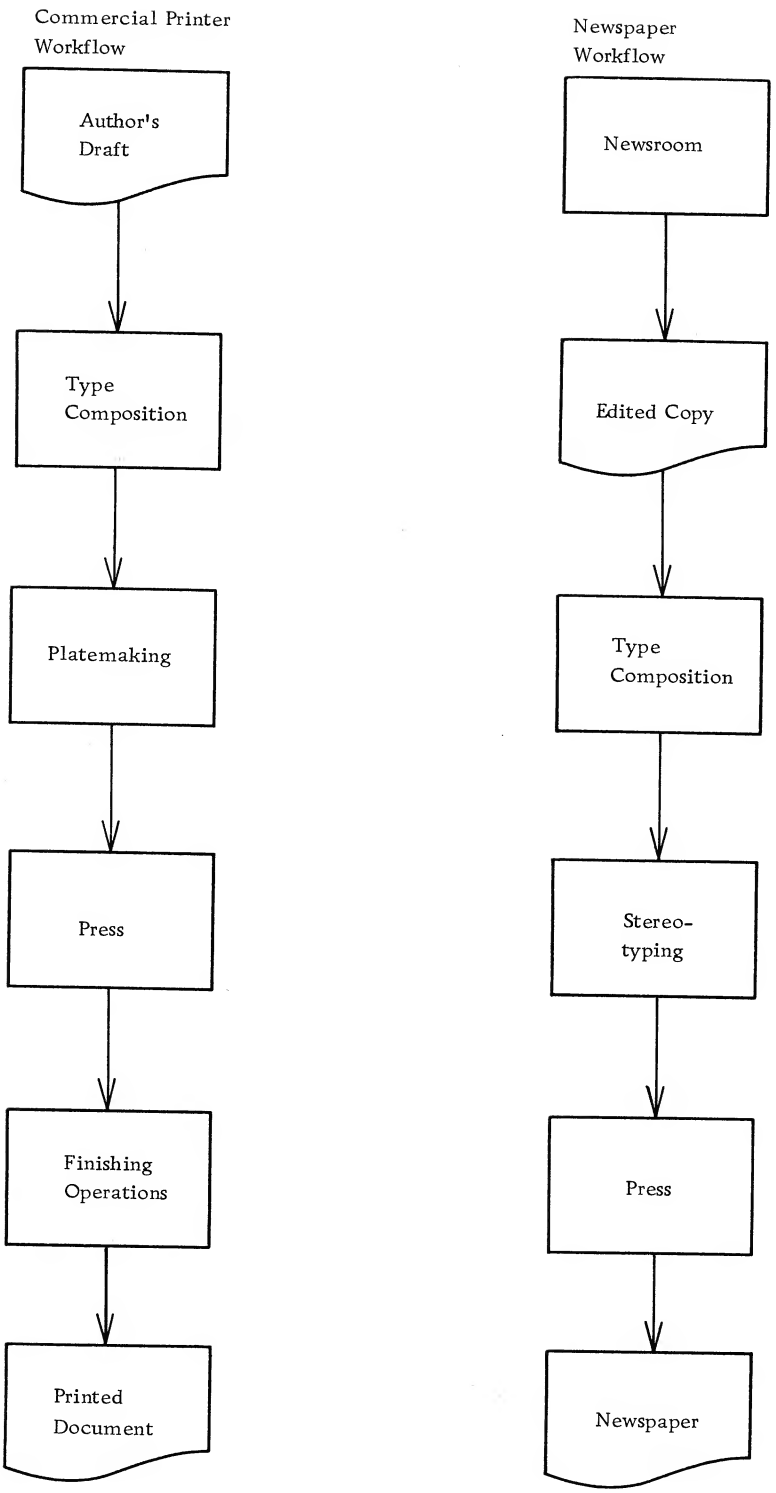
Or consider another type of printing organization — a commercial printer — and the uses to which additional time could be put there. Again, depending on circumstances, a gain in time could be used to (1) accept more work than was previously possible, (2) achieve greater reliability of delivery of completed work, or (3) complete and deliver work earlier. Each of these considerations directly or indirectly affects the number of work orders which a commercial printer can accept and is therefore directly related to revenue.

Hence, a broad area of investigation for this application is defined: Can a general purpose digital computer save time and money in a printing organization?

Focusing attention first on newspapers, consider the accompanying flowchart of the operations involved in the production of a typical newspaper. At what point can time be gained in this cycle?

The length of the press run is the function of the edition's circulation and the operation speed of the presses — a factor which is fixed with regard to maximum capacity. With present production techniques the time for stereotyping (making flat page forms into curved plates that go on the press) is fixed for a given number of pages. Time taken from the news department can only result in incomplete coverage of news, or perhaps no coverage at all, and this is out of the question where the lifeblood of the newspaper is concerned.

The only remaining area is that of the composing room. Any reduction of time must of necessity come from here.


Commercial Printer Workflow
Author's Draft
Type Composition
Platemaking
Press
Finishing Operations
Printed Document
Newspaper Workflow
Newsroom
Edited Copy
Type Composition
Stereo-typing
Press
Newspaper

Similarly, an analysis of a typical commercial printer's operation as depicted in the accompanying flowchart yields the same conclusion. The time required for finishing operations such as cutting, folding, and binding is fixed for a given number of sheets by the operating speed of the finishing equipment. The length of the press run depends solely on the number of sheets to be printed and the operating speed of the presses. The process of producing plates for the presses is fixed for a given number of pages.

Therefore, in a commercial printer as well as in a newspaper, a reduction in time can come in the composing room.

Under present operating conditions, a significant decrease in the total throughput cycle time of a composing room using tape-operated line-casting machines can result from an increase in the speed and accuracy of tape perforation and allocation of that tape to appropriate points.

The 1130 Type Composition Program applies the speed and flexibility of a general purpose digital computer to this problem.

In order for the reader to fully understand the function and scope of the program, a basic knowledge of the present procedures involved in the composition of type must be acquired. This, in turn, requires at least a layman's understanding of the function and operation of some of the machines and procedures employed in the composing room of a printing organization. The remainder of this section provides this information.

COMPOSING ROOM OPERATION

The procedures and techniques used in type composition in printing organizations vary, of course, with the type and size of the organization. The following discussion of the operation of a newspaper's composing room is presented as being representative of composing room operation in general.

The composing room is a part of the production department of a newspaper. It functions as a service organization to convert written or typewritten copy into metal type and to insert this type into page forms at the directions of the news department, thus permitting the stereotype department to make the curved printing plates that go on the presses.

The news department sends edited copy — typewritten, teletyped, or handwritten — to the composing room, usually via some sort of conveyor system.

The composing room operation actually begins at the copy cutter's desk, where the copy is received from the news department. The copy cutter functions as a "scheduler" for the composing room. He classifies the copy according to general news, advanced news, sports, society, etc.,

enters the copy on the schedule sheet with a sequential number and a keyword identification, and marks the copy to indicate (from instructions supplied by the news department) how it is to be "set" — column width, type font, boldface, indentation, picture cuts, etc. He assigns all headlines to special linecasting machines (head machines), capable of setting the special type fonts required, and sometimes cuts long pieces of normal copy into shorter "takes" to ensure faster processing through the composing room.

The necessity of the latter operation is dictated by the availability of linecaster or perforator operators in relation to the remaining time before page deadline. In general, the copy cutter must maintain an orderly flow of copy through the composing room in the sequencing required to meet the deadline.

The next operation involves the actual "setting" of the copy into type with the linecasting machine. If the linecasters are manually operated, each machine operator obtains copy from the copy cutter's desk and sets it into type, following the format instructions indicated by the copy cutter. He then takes both the original copy and the resulting "galley" of type to the dump bank, and repeats the procedure.

If the linecasting machines are tape-operated, the tape must, of course, be perforated before going to the linecasters. This intermediate function is performed by perforator operators, who receive the same marked copy that linecaster operators get in manual operations. Using a machine designed specially for this purpose, the perforator operator creates a six-channel paper tape containing codes representing the copy to be "set" into type, interspersed with function codes that control the linecaster during the casting operation. This tape is then taken with the original copy to the linecasting machines, where the type is created and forwarded to the dump bank.

All type and copy is assembled into complete stories at the dump bank. Once the story is completed and is in type form, the dump bank operator runs off the required number of proofs. One of these proofs is combined with the original copy and sent to the proof room for proofreading. The type is then placed in the correction bank rack to be held while the proofs are read.

In the proof room, the proofreaders check the proof against the original copy to verify numbers, proper names, typographical errors, etc. Corrections, if any, are marked and the proof is sent back to the correction bank. The original copy is usually held in the proof room for further reference and for filing the next day.

When the proof is received at the correction bank, it is checked for required corrections. If no corrections are indicated, the galley of type is sent to the makeup bank rack. If there are corrections, the proof is normally sent to a linecasting machine (ring machine) which is used especially for setting correction lines. When the corrected lines of type are returned to the correction bank, they are inserted in the galleys and the incorrect lines are removed. The galley is then sent to the makeup bank rack.

The operator of the makeup bank checks all galleys of type against a copy of the schedule written by the copy cutter to ensure against loss of copy. He also marks on the page layouts supplied by the news department the "take" numbers assigned to the stories.

A makeup man then physically carries the galley of type to the page forms and transfers the type to it as called for by the layout. The news department makeup men usually direct this operation to ensure that the final page makeup will conform to their original design. Normally, the page forms already contain the display advertisements and pictures in their proper locations, before the insertion of news type.

The composing room makeup men must ensure that each story fits in its assigned space. If the story is too short, they might add space between lines or ask a news department makeup man to add a short story to complete the page. If the story is too long, they ask him for appropriate deletions.

Once a page is completed, it is "locked up" with pressure from side and bottom to ensure a tight fit and transported to the stereotype department, where the page is molded. The flow of pages is recorded on a schedule which indicates the page number and the time of release to stereotype.

LINECASTING MACHINES

Linecasting machines have been standard equipment in composing rooms of the printing and publishing industry for many years. They aid immeasurably in speeding up the composition of type by allowing the operator to automatically assemble the component characters and spaces of a line, and to form the mold from which the finished line of type is cast.

An operator using a linecasting machine composes a line by assembling matrices and spacebands into justified lines.

A matrix is a small piece of brass with a letter of the alphabet, a figure, or some other character recessed into its edge. It is used as a mold to reproduce a corresponding character in type. The linecasting machine magazine normally contains 90 channels of matrices — one channel for each of the 90 keys on the keyboard — with each channel having a capacity for approximately 20 identical matrices. The release of a matrix from the linecasting machine magazine is the final result of a sequence of operations begun with the touch of a key on the keyboard. When a line of matrices has served for casting the line of type, each matrix is automatically distributed back to its proper channel.

The spaceband consists of a unit of two thin wedge-shaped pieces of metal used as spacers between words of a line. This wedge shape produces, in effect, a variable amount of space or expansion between words — a fact which the operator must consider in justifying a line of type. Upon completion of the line, the spacebands are automatically separated from the matrices and returned to the spaceband box. Each

line of type must contain at least one spaceband when line justification is required.

As the manual operator "keyboards" copy, matrices are released from the magazine. The matrices fall by gravity to a conveyor belt, which carries them into an assembling elevator, assembling matrices into words. In response to the operator's touch of the spaceband lever at the right time, spacebands drop between words. Visual judgment of justification is accomplished by the operator's knowledge of total expansion of the spacebands in the line compared with the amount of space left to fill the line. If the line fails to justify, the operator must add the required extra spacing to the line — either by adding another word or syllable (hyphenation), or by adding extra fixed spaces between words and/or letters of words. The latter choice may of course, necessitate the resetting of the entire line.

The matrices and spacebands selected to form the line of type are then elevated and transferred automatically to the casting mechanism, where they are locked in place against the mold. Just before casting the line, the wedge-shaped spacebands are forced upward to spread the line to the exact preset column width. This is known as justification.

A slug, or line of type, is formed by forcing molten lead into the mold, thereby filling the depressions of the letters in the matrices and at the same time forming the body of the slug.

The metal in the mold cools and hardens almost instantaneously. The slug is then ejected, trimmed, and delivered to the galley, and the matrices and spacebands are redistributed to their storage channels.

In summary, a linecasting machine is, in simplest terms, a device which (1) assembles the component matrices of a line of type when an operator depresses the appropriate characters on a keyboard, (2) produces a printable line of type by positioning the matrices against a casting mechanism which molds the line of printing characters on a slug, and (3) transfers the matrices back to their original positions in a magazine where they can be reused.

Typical linecasting machines have maximum rated speeds in the range of 10 lines* per minute (600 lines per hour). This throughput, however, cannot be attained by manual operators because operational procedures, justification decisions, variable keyboard rhythm, etc., prevent maximum operation. Typical throughput rates for a manual operator are 160-200 lines per hour. Even though one operator is required for each manually operated linecasting machine, total composing room throughput capacity is rarely realized because of delays in obtaining copy and other scheduling considerations.

* A line of type refers to one newspaper column. Normally, for measurement purposes, it consists of 30 characters and/or spaces, and is approximately eleven picas wide.

TAPE-OPERATED LINECASTING MACHINES

Until recent years linecasting machines could be utilized only by an operator sitting at the keyboard. Today, they can be operated automatically by a paper tape-controlled device, known as an operating unit, which attaches directly to the linecasting machine keyboard. Once the machine is so equipped, it may be converted from automatic to manual operation (or vice versa) by turning the tape feed control lever on the operating unit.

The function of the operating unit is to sense code combinations in the tape and translate them into mechanical actions for automatic operation of the linecasting machine.

Once tape has been supplied, the linecasting machines can operate at rates approaching the maximum of 600 lines per hour. The actual rate depends on how "clean" the input tape is — that is, how many "rubout" or other nonusable codes the tape contains, and how well the linecaster is "instructed" by the functional codes interspersed with the textual codes in the tape. This, of course, depends on the ability of the tape perforators. The latter point is important because damage to the linecasting machine can result from incorrect functional codes, often causing expensive delays for repair or maintenance. On the other hand, consistently clean tape can prolong the life of a linecaster and improve the efficiency and throughput ability of a composing room.

One linecasting machine monitor can normally operate and maintain up to four machines even at peak loads.

TAPE PERFORATORS

Since the linecaster operating unit is actuated solely by the perforations in the tape, it is obvious that the tape must not only incorporate provisions for all intermediate linecasting machine functions, but also select the characters and figures desired in the finished line of type. It follows that the person preparing the paper tape for input to the operating unit must have an understanding of the functions of a linecasting machine in order to correctly insert linecasting control codes with the actual textual codes that are to appear in print.

It follows also that the tape perforation device must have the ability not only to punch all of the printable character and linecasting control codes, but also to "simulate" the visual justification ability of a manual linecasting machine operator.

The Teletypesetter (TTS) Perforator is the machine most commonly used to prepare paper tape for input to the tape-controlled linecasters. In addition to a keyboard resembling a standard typewriter, the perforator contains a counting pointer and spaceband justification pointers which automatically indicate the width of each character and the minimum and maximum expansion limits of the spacebands. The function of these pointers is essential to the operation of the perforator since the operator has no other means of determining justification of the line being punched.

Perforator operators can normally produce tape at rates in the range of 375 to 425 lines per hour. Note that this is approximately twice the speed of a manual linecasting machine operator. Even though speed is important, the ability to produce "clean" tape is also a prerequisite, since the operators are controlling a remotely located linecasting machine. The requirements of speed and accuracy in a complex job make the function of tape perforation important to the success of any composing room using tape-operated linecasting machines.

It is in this area of tape preparation for and distribution to linecasting machines that the 1130 Type Composition Program can be used as an aid to the composing room operation.

PURPOSE AND OBJECTIVES OF PROGRAM

The IBM 1130 Type Composition Program is designed to allow computer acceptance of a perforated paper tape containing the copy that is to appear in printed form and instructions pertaining to the desired printing format, from which a tape suitable for controlling the operation of a linecasting machine is produced and allocated to the proper point in the composing room.

Under the direction of a printer-oriented format control language, the program will produce properly justified lines in any format within the inherent limitations of the linecasting machine.

Since format is specified in terms of the final printed output material, the program assumes the burden of justification decisions, hyphenation decisions, and proper insertion of linecasting machine control functions, thus allowing perforator operators to concentrate on speed and accuracy in perforating textual material.

The objective of this program, in addition to shorter composing room time requirements in the form of faster, more accurate tape perforation and reduced tape-handling time, is to provide a base from which the inherent capabilities of a digital computer can be extended to other problem areas in type composition.

EXTENT OF COVERAGE

The 1130 Type Composition Program provides for a wide range of stylistic and graphic requirements. In conjunction with the flexible format control language, several constants that can be varied by the user are included to provide the user with additional control over the copy which is to appear in print. In order to provide this flexibility, the program must provide for the variations in linecasting equipment which exist. However, because of the number of special devices available on linecasters and the local modifications of linecasters, it is not possible to write a generalized program which makes provision for each of these numerous variations. The Type Composition Program does contain the logic for the most commonly used special devices and allows program changes for less frequently used devices and local modifications to be easily implemented. In addition, the user can extend program flexibility to areas such as accumulation of production statistics.

ADVANTAGES

Time required by the composing room to "set" type is reduced by increasing the speed of tape perforation and decreasing tape-handling time. Operators can concentrate on speed and accuracy in perforation of textual material since all justification, hyphenation, and linecaster control functions are supplied by the computer. This also implies that machines designed solely to perforate tapes for input to linecasting machines are not necessarily required, although compatibility is maintained.

Increased tape perforation speeds can be used to increase the total throughput capacity of the composing room with no increase in personnel requirements. This is very important when operating under peak-load conditions.

Tape perforator operator training periods should be reduced. Proficiency levels approaching those of normal typists should be realized quickly, since extensive knowledge of type composition techniques is no longer required. Once the format instructions are indicated, the function of an operator reduces to that of a typist.

Consistent graphic quality is maintained with regard to print density and word and letter spacing. This function is no longer dependent upon the varying ability of perforator operators.

Errors and nonusable codes in the tapes produced to operate the linecasting machines are minimized, resulting in fewer reset lines and greater operating efficiency of the linecasters.

Tape-handling requirements should be reduced by the computer's ability to accept input copy from multiple tape preparation stations and to allocate the resulting output tapes to the proper linecasting machine locations without manual intervention.

APPLICATION-ORIENTED CONCEPTS

Inherent in the concept of computer type composition is a method of communication between the perforator operator and the computer. This communication is in the form of format instruction codes, which are punched concurrently with the copy that is to appear in print and can be distinguished from the copy by the computer.

These instruction codes, in their entirety, constitute a format control language that permits the user to design the appearance of the printed output, subject only to the restrictions imposed by the linecasting machine itself. For example, provision is made for defining type fonts to be used; varying column width within a take; indenting takes, paragraphs, or lines an indicated number of spaces from the left, right, or center; setting paragraphs, lines, or words in boldface or italics; quadding a line right, left, or center; indicating an end of line, paragraph, or take; etc.

In the development of the control language, consideration was given to simplicity of design and format, the number of keystrokes required to indicate a given function, the uniqueness of control codes in relation to text material, and compatibility with existing and contemplated tape perforation equipment. The design of this language is such that the user need have only a very basic understanding of the linecasting machine which will produce the final type.

MACHINE-ORIENTED CONCEPTS

The arithmetic capabilities of the 1130 computer are utilized to full advantage in solving the problem of hyphenation occurring at the end of lines. The solution is based primarily on a technique of analyzing probabilities of syllabic division points occurring before, after, and between the letter combinations which make up the word. This technique cannot, of course, provide absolute accuracy because the alphabetic structure of a word does not always reflect its division points. This problem is alleviated by entering "exceptions" to the rule in a table contained in disk storage, and searching this table before analyzing the word. A word compression technique is used for these exception words in order that available file space may be utilized more effectively.

Accepting input tapes from multiple input stations and distributing the resulting output tapes to multiple output stations is made possible by the capabilities of the 1131 Processor. Up to eight input readers on the basic system are scanned by the program for service requests. The program sequentially processes tape from all readers online and distributes the output tapes to as many as eight punches on the basic system according to the requested font and column width. These punches will normally be located adjacent to linecasting machines whose current settings conform to the linecaster schedule table in the computer. This table can be changed automatically whenever the linecaster settings are changed.

TIMING

The unit most commonly used in measuring throughput rates of composing room equipment is lines per hour. A line refers to one newspaper column width (approximately eleven picas) and is normally standardized at 30 characters.

Computer throughput rates vary within certain limits according to column widths, desired output format, frequency of hyphenation, and, of course, speed of input/output devices. The 1130 Type Composition Program, therefore, operates within a range of 10,000 to 12,000 lines per hour, assuming input/output devices that operate at 100 character per second (the rate for the most commonly used input/output units for this application).

MACHINE CONFIGURATION

1131 Processor, Model II B
and either:

{1054 Paper Tape Reader
{1055 Paper Tape Punch

or

1442 Card Read Punch, Model 6 or 7

And the following RPQ's for user-provided 6-channel advanced-feed-hole paper tape readers (PTR's) and paper tape punches (PTP's)*:

RPQ 834398 I/O channel (basic interface)
RPQ 834399 PT attachment (1 PTR and 1 PTP)

For more than one PTR and PTP:

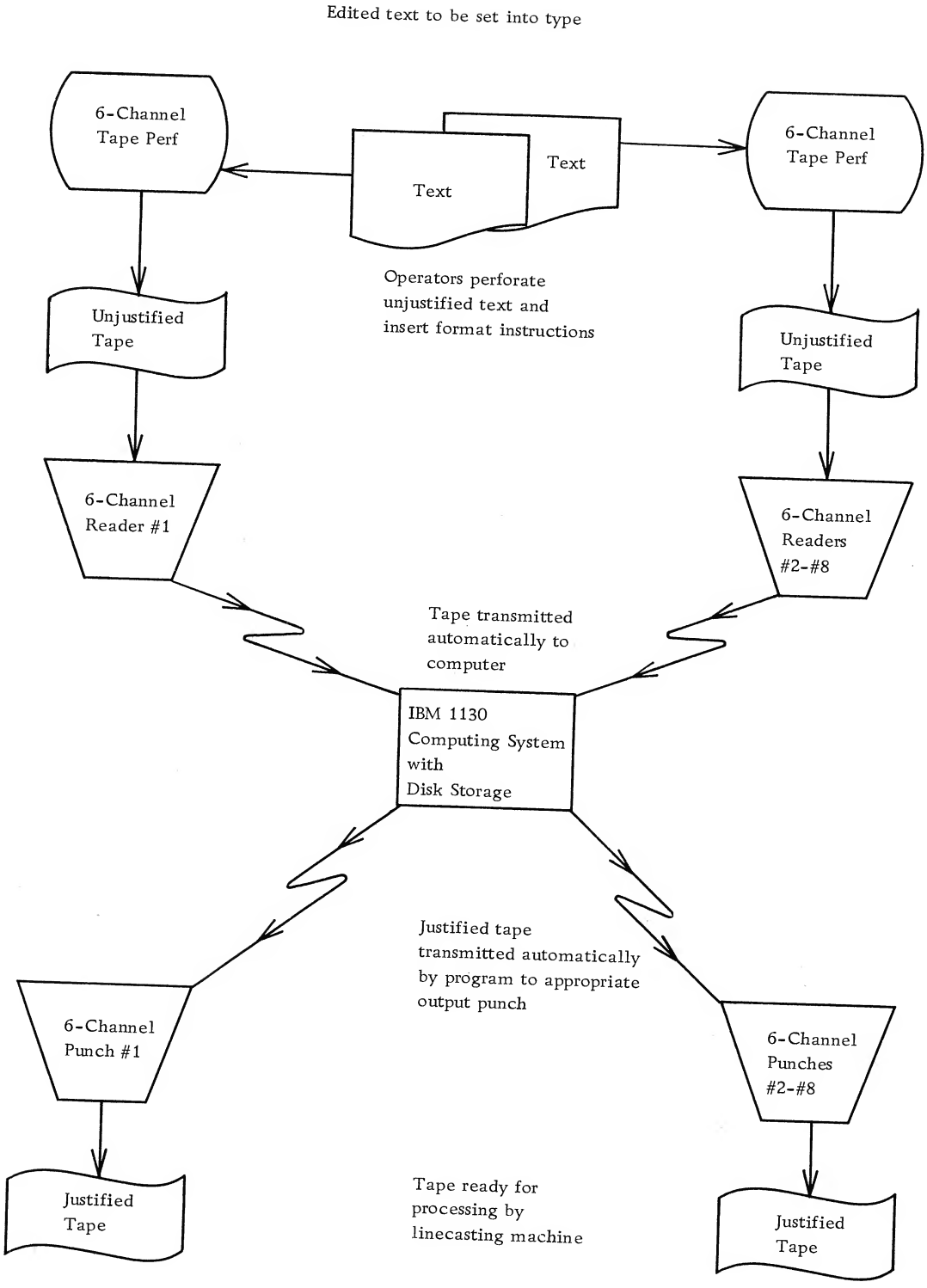
RPQ 834400 multiple capability

For each PTR and PTP after the first:

RPQ 834401 additional PTR interface
RPQ 834402 additional PTP interface

* A maximum of eight PTR's and eight PTP's may be attached.

GENERAL SYSTEMS CHART



Printed in U.S.A. H20-0139-0

IBM®

International Business Machines Corporation
Data Processing Division
112 East Post Road, White Plains, New York 10601

IBM **Technical Newsletter**

Re: Form No. H20-0139-0

This Newsletter No. N20-0057-0

Date February 25, 1966

Previous Newsletter Nos. None

1130 TYPE COMPOSITION PROGRAM
APPLICATION DESCRIPTION

Please replace page 12 of the subject manual with the page attached to this newsletter. Notice the use of the 1134 Paper Tape Reader, and a new maximum of sixteen paper tape readers (PTR's) and sixteen paper tape punches (PTP's).

File this newsletter at the back of the manual. It will provide a reference to changes, a method of determining that all amendments have been received, and a check for determining whether the manual contains the proper pages.

IBM Corporation, Technical Publications Dept., 112 E. Post Road, White Plains, N.Y. 10601

Printed in U.S.A.

N20-0057 (H20-0139-0)

MACHINE CONFIGURATION

1131 Central Processing Unit, Model 2B
2315 Disk Cartridge

and either:

{1134 Paper Tape Reader
{1055 Paper Tape Punch

or

1442 Card Read Punch, Model 6 or 7

And the following RPQ's for user-provided 6-channel advanced-feed-hole paper tape readers (PTR's) and paper tape punches (PTP's)*:

RPQ 834398 Basic Interface (required to attach any number of PTR's and PTP's)

RPQ 834399 Paper Tape Attachment (required to attach any number of PTR's and PTP's)

For more than one PTR and more than one PTP:

RPQ 834400 Interface Expander (required to attach PTR numbers 2 through 8 and/or PTP numbers 2 through 8)

RPQ E36610 Second Interface Expander (required to attach PTR numbers 9 through 16 and/or PTP numbers 9 through 16)

RPQ 834401 Additional PTR Interface (one required for each PTR, numbers 2 through 16)

RPQ 834402 Additional PTP Interface (one required for each PTP, numbers 2 through 16)

* A maximum of sixteen PTR's and sixteen PTP's may be attached.